

MECHATRONICS BOOK SERIES

ROBOTICS AND AUTOMATION

Rini Akmeliawati
Wahju Sediono
Nahrul Khair Alang Md. Rashid



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MECHATRONICS BOOK SERIES: ROBOTICS AND AUTOMATION

Editors

Rini Akmeliawati
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TABLE OF CONTENTS

Preface	i
Acknowledgement	ii
Editor	iii
Table of Content	v
1. Visual Tracking for Human Face A.A. Shafie, Iqbal and M.R. Khan	1
2. Robot Design : A Case Study of Team Learning Experience and Outcome A.A. Shafie	7
3. Development Neck Support for Humanoid Robot Head A. A. Shafie, M.N. Kasyfi and N. I. Taufik Y	14
4. Development of Cooperative Mini Robot Amir A. Shafie , Siti E.M.Z and Shazeela A	21
5. Humanoid Robot Arm Amir A. Shafie and Mohd N. Y.	26
6. Designing Human Robot Interaction for Emotionally Expressive Robotic Hear AMIR-III A. Iqbal, A. A. Shafie, and M. R. Khan	32
7. An Overview of Fuzzy Based Person Following Robot T. Alamgir, I. J. Alfar and M. M. Rashid	38
8. Mechanical Design of a Person Following Robot Tarik Bin Alamgir, Ibrahim Jawad Alfar and Muhammad Mahbubur Rashid	43

9. Development of Fuzzy Based Person Following Robot part 2	49
Tarik Bin Alamgir, Ibrahim Jawad Alfar and Muhammad Mahbubur Rashid	
10. Mobile Robot for Fined Tube Inspection	56
Muhammad Mahbubur Rashid	
11. Robot Aided Upper Limb Rehabilitation System: Mechanical Design	
Shahrul Na'im Sidek, Hidayatullah Mohamed Nawi	64
12. Robot Aided Upper Limb Rehabilitation System: Electronics for Sensors and Actuators	69
Shahrul Na'im Sidek, Khairul Anwar Khalid	
13. Robot Aided Upper Limb Rehabilitation System: Results and Analysis	73
Shahrul Na'im Sidek	
14. Snake Robot Locomotion in Narrow Space: A Review	79
Raisuddin Khan, Mitsuru Watanabe and Masum Billah	
15. Multiple Hexapod Robot and Collaborative communication	86
Raisuddin Khan, Masum Billah and Mohiuddin Ahmed	
16. Autonomous Unicycle Robot Using Reaction Wheel Pendulum: Mechanical Design	94
Atika Adrina Teepol, Nur Fadhilah Mohd Fauzey, Shahrul Na'im Sidek, Yasir Mohd Mustafah	
17. Autonomous Unicycle Robot Using Reaction Wheel Pendulum: Controller Design	103
Nur Fadhilah Mohd Fauzey, Atika Adrina Teepol, Shahrul Na'im Sidek, Yasir Mohd Mustafah	

HISTORICAL BACKGROUND AND EDUCATION

19. **Develop an Algorithm for Goal Finding Robot using Reinforcement Learning** 118
M. Kamal, R. Khan, S. Bazuhair and M. Billah

20. **Design and Development of 2 Fingers Robotic Hand Actuated by Active Grasping Data** 126
MdMozasser Rahman¹, MohdZoolfadli B MdSalleh

21. **Design and Development of Interactive Fish Robot** 144
MdMozasser Rahman¹, RizaMuhida and Mohammad Zukhair b MohdNazmi

22. **Design and Development of A Digger Robot** 154
MdMozasser Rahman, MohdRuzaini Bin AbdRahim and Others

23. **Glass Wall Cleaning Robot: A Review** 170
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin

24. **Glass Wall Cleaning Robot: -Electrical design and control** 177
Md Mozasser Rahman, Ahmed Murgab Mohammed Mahil, Norsofiana Bt Umar and Nurul Izzati Bt Samsuddin

25. **Glass Wall Cleaning Robot: -Electrical design and control** 187
M. M. Rahman, M. R. b A. Ralim

- ✓ 26. **Development of Robotic Manipulator to assist human using brain Signal** 198
Mahbuba Hossain, Raisuddin Khan, and Masum Billah

- ↳ 27. **Glass Wall Cleaning Robot: Mechanical Design** 204
Mahbuba Hossain Raisuddin Khan, and Masum Billah

28. Intelligent SCADA Based Monitoring Scheme for Low Voltage Distribution System	210
M. J. E. Salami, A. M. Aibinua, Mohd Shafie Bin Sani and Nurfaizal Bin Wahi	
29. Intelligent SCADA Based Monitoring Scheme for Low Voltage Distribution System	218
Abdullateef Ayodele Isqeel and Momoh Jimoh Eyiomika Salami.	
30. Autonomous Goal Finding Robot	227
M. Kamal, Md. R. Khan, Faisal and M. Billah	
31. Intelligent SCADA Based Pipe Monitoring System	236
M. J. E. Salami, A. M. Aibinua, Mohd Shafie Bin Sani and Nurfaizal Bin Wahi	
32. Path Tracking of Car Like Mobile Robot	250
A. A. Isqeela and M. J. E. Salami	
33. A New Energy Efficient Building System	255
M. J. E. Salami, Md. R. Khan, O. A. Abdulquadric	
34. Automatic Car Parking System	262
M. J. E. Salami, Md. R. Khan and O. A. Abdulquadria	
35. Anthropomorphic biped robot	267
A. A. Shafie, M. F. Baharudin	

CHAPTER 31

Development of an Intelligent Controller for Tropical Food Storage System

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31.1. Introduction

31.1.1 Background

The traditional methods of food storage employed in the western region of Africa often result in heavy losses of edible food. The reason can be adduced to the open nature of the food storage units which are prone to environmental influences. One way to ensure a nations food security is to encourage proper and adequate storage of harvested products. Other advantages of proper food storage are availability of the products outside their seasons which often lead to relatively stable market prices.

Physiological processes occurring within the body of freshly harvested food products often result in the release of heat, moisture, carbon-dioxide and ethylene gases. To prolong the shelf life of harvested food products, there is a need to properly evacuate the mentioned by-products from the storage environment.

While the traditional methods of food storage practiced in West Africa results in heavy losses, other parts of the world especially the developed ones, employ more efficient methods such as the model- and intelligent-based control methods. These methods employ automatic means for storing food products.

31.1.2 Problems associated with the food storage process

The food storage process consists of conditioning air and passing it through a column of the products in the storage unit. Employing automatic control of the process reduces the operational cost of the process. Depending on the product under storage, the air is conditioned for a certain temperature and relative humidity level. During the storage process, the air flowing thru the product pile loses its heat and moisture receiving capacities, thus resulting in the formation of a temperature and moisture gradient within the storage volume. These gradients often result in differential cooling and drying within the same storage unit thus resulting in loss in product quality and quantity especially at the downstream of the storage unit. Another common problem in the storage process involves the formation of hot zones probably due to trapped air in some zones within the storage unit. Drying of the stored products is another problem encountered in the storage process. This problem can possibly be due to flow fluctuations occurring at the entry point and as a result of the turbulent nature of the airflow (Xu and Burfoot, 1999).

31.1.3 Objectives of the study

The main objective is to develop an intelligent controller to control the storage process for tropical postharvest products.

Specific objectives include amongst others:

- the development of a mathematical model for predicting storage parameters such as airflow, temperatures, and relative humidity and the weight loss of products under storage.
- the design and fabrication of an n-compartment prototype storage unit and a 4-compartment storage unit for tropical postharvest products.